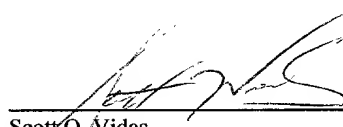


FORM PTO-1390 (REV 10-94)      U.S. Dept. of Commerce and Patent and Trademark Office <b>TRANSMITTAL LETTER TO THE UNITED STATES</b> <b>DESIGNATED/ELECTED OFFICE (DO/EO/US)</b> <b>CONCERNING A FILING UNDER 35 U.S.C. 371</b>		ATTORNEY'S DOCKET NUMBER: <b>S40.2-9755</b>  U.S. APPLICATION NO. (if known): <b>09/786307</b>
INTERNATIONAL APPLICATION NO.: <b>PCT/KR99/00514</b>	INTERNATIONAL FILING DATE (dd/mm/yy): <b>03/09/99</b>	PRIORITY DATE CLAIMED (dd/mm/yy): <b>03/09/98</b>
TITLE OF INVENTION: <b>DIAMOND BLADE HAVING RIM TYPE CUTTING TIP FOR USE IN GRINDING OR CUTTING APPARATUS</b>		
APPLICANT(S) FOR DO/EO/US: <b>Sookwang KIM, Soyoung YOON and Changhyun LEE</b>		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
<ol style="list-style-type: none"> <li>1.    <input checked="" type="checkbox"/>    This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2.    <input type="checkbox"/>    This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3.    <input checked="" type="checkbox"/>    This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</li> <li>4.    <input checked="" type="checkbox"/>    A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li>5.    <input checked="" type="checkbox"/>    A copy of the International Application as filed (35 U.S.C. 371(c)(2))           <ol style="list-style-type: none"> <li>a.    <input type="checkbox"/>    is transmitted herewith (required only if not transmitted by the International bureau).</li> <li>b.    <input checked="" type="checkbox"/>    has been transmitted by the International Bureau.</li> <li>c.    <input type="checkbox"/>    is not required, as the application was filed in the United States receiving Office (RO/US).</li> </ol> </li> <li>6.    <input type="checkbox"/>    A translation of the International Application into English (35 U.S.C. 371 (c)(2)).</li> <li>7.    <input checked="" type="checkbox"/>    Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))           <ol style="list-style-type: none"> <li>a.    <input type="checkbox"/>    are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b.    <input type="checkbox"/>    have been transmitted by the International Bureau.</li> <li>c.    <input type="checkbox"/>    have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d.    <input checked="" type="checkbox"/>    have not been made and will not be made.</li> </ol> </li> <li>8.    <input type="checkbox"/>    A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li>9.    <input type="checkbox"/>    An oath or declaration of the inventor (35 U.S.C. 371(c)(4)).</li> <li>10.    <input type="checkbox"/>    A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> </ol>		
<b>Items 11. to 16. below concern other document(s) or information included:</b>		
<ol style="list-style-type: none"> <li>11.    <input type="checkbox"/>    An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li>12.    <input type="checkbox"/>    An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.29 and 3.31 is included.</li> <li>13.    <input type="checkbox"/>    A <b>FIRST</b> preliminary amendment. Please enter the amendment before fee calculation.</li> <li>      <input type="checkbox"/>    A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</li> <li>14.    <input type="checkbox"/>    A substitute specification.</li> <li>15.    <input type="checkbox"/>    A change of power of attorney and/or address letter.</li> <li>16.    <input type="checkbox"/>    Other items or information:</li> </ol>		

17. <input checked="" type="checkbox"/> The following fees are submitted:  <b>BASIC NATIONAL FEE (37 CFR 1.492(A)(1)-(5)):</b> <i>(select the appropriate one of the following fees)</i> Search Report has been prepared by the EPO or JPO ..... \$ 930.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... \$ 490.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... \$ 750.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$ 1,070.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Articles 33(2)-33(4) ..... \$ 98.00  <div style="text-align: right;"><b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b></div>	<b>CALCULATIONS</b>	<b>PTO USE ONLY</b>																																																																														
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	\$0.00																																																																															
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%;">CLAIMS</th> <th style="width: 20%;">NUMBER FILED</th> <th style="width: 20%;">NUMBER EXTRA</th> <th style="width: 20%;">RATE</th> <th style="width: 20%;"></th> <th style="width: 20%;"></th> </tr> <tr> <td>Total Claims</td> <td style="text-align: center;">16 - 20 =</td> <td style="text-align: center;">0</td> <td style="text-align: center;">x \$ 22.00</td> <td style="text-align: center;">\$0.00</td> <td></td> </tr> <tr> <td>Independent Claims</td> <td style="text-align: center;">2 - 3 =</td> <td style="text-align: center;">0</td> <td style="text-align: center;">x \$ 82.00</td> <td style="text-align: center;">\$0.00</td> <td></td> </tr> <tr> <td colspan="3">Multiple Dependent Claims (if applicable)</td> <td style="text-align: center;">+ \$ 270.00</td> <td style="text-align: center;">\$0.00</td> <td></td> </tr> <tr> <td colspan="4" style="text-align: right;"><b>TOTAL OF ABOVE CALCULATIONS =</b></td> <td style="text-align: center;">\$1,070.00</td> <td></td> </tr> <tr> <td colspan="4">Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must be filed also. (Note 37 CFR 1.9, 1.27, 1.28).</td> <td style="text-align: center;">\$0.00</td> <td></td> </tr> <tr> <td colspan="4" style="text-align: right;"><b>SUBTOTAL =</b></td> <td style="text-align: center;">\$1,070.00</td> <td></td> </tr> <tr> <td colspan="4">Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).</td> <td style="text-align: center;">\$0.00</td> <td></td> </tr> <tr> <td colspan="4" style="text-align: right;"><b>TOTAL NATIONAL FEE =</b></td> <td style="text-align: center;">\$1,070.00</td> <td></td> </tr> <tr> <td colspan="4">Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property</td> <td style="text-align: center;">\$0.00</td> <td></td> </tr> <tr> <td colspan="4" style="text-align: right;"><b>TOTAL FEES ENCLOSED =</b></td> <td style="text-align: center;">\$1,070.00</td> <td></td> </tr> <tr> <td colspan="4"></td> <td style="text-align: center;">Amount to be: Refunded</td> <td style="text-align: center;">\$</td> </tr> <tr> <td colspan="4"></td> <td style="text-align: center;">Charged</td> <td style="text-align: center;">\$</td> </tr> </table>	CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE			Total Claims	16 - 20 =	0	x \$ 22.00	\$0.00		Independent Claims	2 - 3 =	0	x \$ 82.00	\$0.00		Multiple Dependent Claims (if applicable)			+ \$ 270.00	\$0.00		<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$1,070.00		Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must be filed also. (Note 37 CFR 1.9, 1.27, 1.28).				\$0.00		<b>SUBTOTAL =</b>				\$1,070.00		Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$0.00		<b>TOTAL NATIONAL FEE =</b>				\$1,070.00		Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				\$0.00		<b>TOTAL FEES ENCLOSED =</b>				\$1,070.00						Amount to be: Refunded	\$					Charged	\$		
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a. <input checked="" type="checkbox"/> A check in the amount of \$1,070.00 to cover the above fees is enclosed.  b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$_____ to cover the above fees is enclosed. A duplicate copy of this sheet is enclosed.  c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 22-0350.																																																																																
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <b>Send All Correspondence To:</b>            Vidas, Arrett &amp; Steinkraus, P.A.            Suite 2000            6109 Blue Circle Drive            Minnetonka, MN 55343-9185            Telephone: (952) 563-3000            Facsimile: (952) 563-3001         </div> <div style="width: 45%; text-align: right;">           By:             Scott Q. Vidas            Registration No. 30,812         </div> </div>																																																																																

09/786307

JC02 Rec'd PCT/PTO 02 MAR 2001

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
UNITED STATES RECEIVING OFFICE (RO/US)**

<b>In re Application of:</b>	Sookwang KIM, Soyoung YOON and Changhyun LEE
<b>U.S. Nat'l Stage of Int'l App. No.:</b>	PCT/KR99/00514
<b>Int'l Filing Date:</b>	September 3, 1999
<b>For:</b>	DIAMOND BLADE HAVING RIM TYPE CUTTING TIP FOR USE IN GRINDING OR CUTTING APPARATUS

Box PCT

ATTN: EO/US

Commissioner for Patents

Washington, D.C. 20231

Docket No.: S40.2-9755

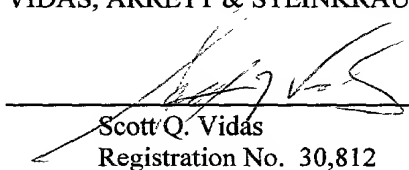
**TRANSMITTAL LETTER**

- In regard to the above-identified application, we are submitting the attached:  
**2 pg. Form PTO-1930 Transmittal; Check \$1,070.00; PCT Request; Published International Application; International Search Report; Notification of Change of Applicant; Notification of Change of Inventor; PCT Written Opinion; VAS Transmittal Letter; and Postcard.**
- With respect to fees:
  - ☐ No additional fee is required.
  - ☒ Attached is check(s) in the amount of \$1,070.00.
  - ☐ Charge additional fee to our Deposit Account No. 22-0350.
- CONDITIONAL PETITION AND FEE FOR EXTENSION OF TIME**
- This conditional petition is being filed along with the papers identified in Item 1 above and provides for the possibility that Applicant has inadvertently overlooked the need for a petition and fee for extension of time. If any extension of time for the accompanying response is required, Applicant requests that this be considered a petition therefor.
- Please charge any additional fees or credit any overpayment associated with this communication to Deposit Account No. 22-0350.

VIDAS, ARRETT &amp; STEINKRAUS

Date: March 2, 2001

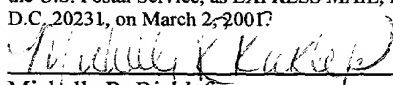
By:

  
 Scott Q. Vidas

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6109 Blue Circle Drive, Suite 2000  
 Minnetonka, MN 55343-9185  
 Telephone: (952) 563-3000  
 Facsimile: (952) 563-3001

**Certificate Under 37 CFR 1.10:** I hereby certify that this Transmittal Letter and the paper(s) as described herein, are being deposited in the U.S. Postal Service, as EXPRESS MAIL, Label No. EL668460077US, addressed to Box PCT, Commissioner for Patents, Washington D.C. 20231, on March 2, 2001.

  
 Michelle R. Ricklefs

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DIAMOND BLADE HAVING RIM TYPE CUTTING TIP FOR USE IN  
GRINDING OR CUTTING APPARATUS.

BACKGROUND OF THE INVENTION

5 The present invention relates to a diamond blade  
for use in apparatus such as a cutting saw machine for  
grinding or cutting crushable materials such as brick,  
concrete, granite, marble, etc., and more particularly to  
10 a diamond blade having rim type cutting tip in which at  
least two diamond layers are longitudinally disposed along  
the rotation direction of the blade to form microscopic  
linear cutting grooves to cause portions of the crushable  
materials between the cutting grooves to be crushed in  
15 chips of relative large size by non-diamond portion of  
the cutting tip during cutting operation and thereby to  
enhance cutting ability of the blade and to prevent  
crushed chips dispersing easily in the air and giving rise  
to the bad effects to user's health and the contamination  
of environment.

20 A conventional diamond blade 1 for use in apparatus  
for cutting crushable materials such as cutting saw  
machine comprises steel wheel body 2 connected with a  
shaft of electric motor, and rim type cutting tip 3  
disposed circumferentially and fixedly on the steel wheel  
body 2, as shown in FIG. 1. Rim type cutting tip 3 is  
25 fabricated by mixing particles of diamond and grinding  
materials, particles of metals composing of cobalt,  
nickel, bronze, copper, etc., and particles of resin or  
ceramic and forming a rim of given shape out of the mixed  
particles by plastic working including press work.

30 Thus, diamond particles 4 are randomly distributed in

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the inside and surfaces of rim type cutting tip 3 as shown in FIG. 3.

5 In the blade 1, upper surface of rim type cutting tip 3 contacts with corresponding surface portion of crushable materials 18 to be cut and grinds it to form cutting slot 16 in crushable materials during cutting operation as shown in FIG.3.

10 Minute chips produced by cutting operation of rim type cutting tip 3 are gathered in cutting slot 16 and then discharged from there to outside by the rotation of rim type cutting tip 3.

15 However, since the blade 1, i.e., upper surface of rim type cutting tip 3 has same shape and material composition on the whole, both edges 15 of upper surface contacting with side wall and bottom of cutting slot 16 formed in crushable materials 18 during cutting operation are defaced faster than center 17 thereof contacting only with bottom of cutting slot 16 of crushable materials 18.

20 Accordingly, the contacting area between upper surface of rim type cutting tip 3 and crushable materials 18 to be cut is enlarged to increase resistance of crushable materials 18 and thereby be able to induce poor cutting and decrease cutting ability and life of blade 1.

25 Further, since size of chips produced during cutting operation is very minute, these chips are easy to remain in cutting slot 16 of crushable materials 18 to prevent upper surface of rim type cutting tip 3 grinding bottom of cutting slot 16 and thereby decrease cutting ability.  
30 Also, in case of those minute chips discharged from cutting slot 16 are dispersed in the air, it gave rise

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to the bad effects to user's health and the contamination of environment.

To improve these problem, there has been proposed a diamond blade 11 that a plurality of depressed portions 19 are at given intervals formed in inner and outer surfaces of rim type cutting tip 13, as shown in FIG.2.

By virtue of this blade, discharging of minute chips remaining in cutting slot of crushable materials causing rim type cutting tip to be defaced during cutting operation has been improved, but defacement of both edges of upper surface to induce poor cutting and decrease cutting ability and life of blade, producing very minute chips to decrease cutting ability, and dispersing produced minute chips in the air to give rise to the bad effects to user's health and the contamination of environment are still remained in problems to solve.

#### SUMMARY OF THE INVENTION

It is an object of the present invention to provide a diamond blade for use in apparatus such as a cutting saw machine for cutting crushable materials such as brick, concrete, granite, marble, etc., having rim type cutting tip in which at least two diamond layers are longitudinally disposed along the rotation direction of the blade to form microscopic cutting grooves in the crushable materials during cutting operation and thereby to cause portion of crushable materials between the cutting grooves to be easily crushed by non-diamond portion of the rim type cutting tip to enhance cutting ability of the blade.

It is another object of the present invention to

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provide a diamond blade for use in apparatus such as cutting saw machine having a structure which rim type cutting tip is able to produce cutting chips with relative large size during cutting operation so that those chips are easily discharged outside with reducing the friction with cutting tip of blade, thereby to increase cutting ability and to prevent those chips dispersing in the air and giving rise to the bad effects to user's health and the contamination of environment.

10 It is the other object of the present invention to provide a diamond blade for use in apparatus such as cutting saw machine having rim type cutting tip which diamond particles in diamond layer thereof are distributed in a given pattern to reduce the amount of diamond  
15 particles used and thereby reduce the manufacturing cost of blade.

To accomplish these objects, a diamond blade for use in apparatus for grinding or cutting crushable materials according to the present invention comprises a wheel body  
20 connected with a shaft of electric motor, and rim type cutting tip for grinding or cutting crushable materials disposed on the circumference of wheel body and composed of at least two diamond layers longitudinally disposed parallel with the rotation direction of the blade in  
25 which diamond particles are included, and non-diamond portion disposed between the diamond layers in which diamond particles are not included.

In this embodiment of the present invention, diamond layers are disposed each other at predetermined intervals  
30 perpendicular with the rotation direction of the blade.

It is desirable that diamond layers are disposed only on inner and outer surface of rim type cutting tip.

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Alternatively, diamond particles in each diamond layer of rim type cutting tip are distributed in a given pattern or arrangement such a single or double layer figure with grid shaped spots.

5 Also, in the non-diamond portion of rim type cutting tip, diamond particles can be distributed in the density lower than that of diamond layers.

10 In the other embodiment of the present invention, a diamond blade for use in apparatus for grinding or cutting crushable materials comprises a wheel body connected with a shaft of electric motor, and rim type cutting tip for grinding or cutting crushable materials disposed on the circumference of wheel body and composed of non-diamond portion having a plurality of depressed portions disposed  
15 at predetermined intervals to cross each other in inner and outer surfaces of non-diamond portion, and a plurality of diamond layers longitudinally disposed parallel with the rotation direction of the blade respectively on bottom surfaces of depressed portions of non-diamond portion and  
20 inner and outer surfaces of non-diamond portion divided by depressed portions thereof.

In this embodiment of the present invention, it is desirable that bottom surfaces of depressed portions of non-diamond portion are positioned in the plane forming  
25 the center between inner and outer surfaces of non-diamond portion to let diamond layers disposed thereon to form one cutting line during the cutting operation of blade.

Also, the depth of all bottom surfaces of depressed portions of inner and outer surfaces of non-diamond  
30 portion can be set up to be less than a half of the thickness of non-diamond portion to let diamond layers disposed thereon to form at least two linear cutting line



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during the cutting operation of blade.

#### BRIEF DESCRIPTION OF THE DRAWINGS

5 The above objects and other advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

10 FIG.1 is a front view of one conventional diamond blade for use in cutting saw machine in which diamond particles are randomly distributed in rim type cutting tip thereof;

15 FIG.2 is a front view of the other conventional diamond blade in which diamond particles are randomly distributed in rim type cutting tip thereof and a plurality of depressed portions are disposed in inner and outer surfaces of rim type cutting tip thereof;

FIG.3 is a partial cross-sectional view of the conventional diamond blade shown in FIG.1 to illustrate state in which rim type cutting tip thereof is operated;

20 FIG.4 is a perspective view of diamond blade for use in cutting saw machine according to one preferred embodiment of the present invention which two diamond layers are longitudinally disposed respectively in inner and outer surfaces of non-diamond portion of rim type cutting tip to form two microscopic linear cutting grooves  
25 in the crushable materials during cutting operation;

FIG.5 is a partial cross-sectional view of the diamond blade of the present invention taken along line A-A of FIG.4 to illustrate state which rim type diamond cutting tip is operated;

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FIG.6 is a perspective view of a diamond blade for use in cutting saw machine according to the other embodiment of the present invention in which a plurality of diamond layers are longitudinally disposed respectively on bottom surfaces of depressed portions of non-diamond portion and inner and outer surfaces of non-diamond portion and the depth of bottom surfaces of depressed portions of non-diamond portion is a half of the entire thickness of non-diamond portion;

FIG.7 is a partial cross-sectional view of the diamond blade of the present invention overlapping cross-sections taken along lines B-B and C-C of FIG.6 to illustrate state which rim type diamond cutting tip is operated;

FIG.8 is a perspective view of diamond blade of the present invention which the depth of bottom surfaces of depressed portions of non-diamond portion is less than a half of the entire thickness of non-diamond portion;

FIG.9 is a partial perspective view of diamond blade of the present invention shown in FIG.8; and

FIG.10 is a partial cross-sectional view of the diamond blade of the present invention overlapping cross-sections taken along lines E-E and F-F of FIG.9 to illustrate state which rim type diamond cutting tip is operated.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In several embodiments of this invention described below with reference to the accompanying drawings, the invention is applied to cutting saw machine.

Referring to FIG.4, there is illustrated diamond

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blade 31 having rim type cutting tip 33 according to one preferred embodiment of the present invention for use in apparatus for grinding or cutting crushable materials such as cutting saw machine.

5 Diamond blade 31 for cutting saw machine comprises wheel body 32 connected with a shaft of electric motor, and rim type cutting tip 33 for cutting or grinding crushable materials fixedly disposed circumferentially on the wheel body 32.

10 Rim type cutting tip 33 comprises two thin diamond layers 38 and 38' longitudinally disposed respectively in inner and outer surfaces thereof parallel with the rotation direction of the blade 31, and non-diamond portion 35 disposed between two diamond layers 38 and 15 38', as shown in FIG.4 and 5.

Thin diamond layers 38 and 38' are composed of particles of diamond and grinding material, particles of metals composing of cobalt, nickel, bronze, copper, etc., and particles of resin or ceramic.

20 Particles 39 of diamond in thin diamond layers 38 and 38' are randomly distributed, or in a given pattern or arrangement such a single or double layer figure with grid shaped spots to reduce the amount of diamond particles used.

25 Non-diamond portion 35 is composed of grinding materials, metals such as cobalt, nickel, bronze, copper, etc., and resin or ceramic.

Thin diamond layers 38 and 38' function to prevent edge area of upper surface of rim type cutting tip 33 defacing and to form two microscopic linear cutting 30 grooves 37' and 37" in the crushable materials 37 during cutting operation, as shown in FIG.5. Thus, portion 40 of

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crushable materials 37 between two cutting grooves 37' and 37" can be easily crushed by small friction and rotation impact power of non-diamond portion 35 and thereby non-diamond portion 35 of rim type cutting tip 33 is able to produce cutting chips with relative large size during cutting operation so that those chips are easily discharged outside with reducing the friction with rim type cutting tip 33 of blade, thereby to increase cutting ability and to prevent it dispersing in the air.

10 In this embodiment of the present invention, it is noted that rim type cutting tip 33 can be substituted by cutting tip composed of three or four thin diamond layers longitudinally disposed therein parallel with the rotation direction of the blade respectively to form three or four  
15 microscopic linear cutting grooves in the crushable materials during cutting operation, and non-diamond portions disposed between the three or four diamond layers.

The diamond layers are each other disposed at  
20 predetermined intervals perpendicular with the rotation direction of the blade between non-diamond portions of cutting tip.

In this case, portion of crushable materials between the microscopic linear cutting grooves can be easily  
25 crushed by friction and rotation impact power smaller than that of non-diamond portion 35 of rim type cutting tip 33 having two thin diamond layers 38 and 38'.

Also, in the non-diamond portion of rim type cutting tip, diamond particles can be distributed in the density  
30 lower than that of diamond layers of rim type cutting tip.

Referring to FIG.6 and 7, there are illustrated diamond blade 41 according to the other preferred

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embodiment of the present invention for use in apparatus for cutting and drilling crushable materials such as cutting saw machine.

5 Diamond blade 41 for cutting saw machine comprises wheel body 42 connected with a shaft of electric motor, and rim type cutting tip 43 disposed fixedly on the circumference of wheel body Rim type cutting tip 43 has non-diamond portion 45 having a plurality of depressed portions 44 disposed at predetermined intervals to cross  
10 each other in inner and outer surfaces of non-diamond portion 45.

Rim type cutting tip 43 further includes a plurality of diamond layers 48, 48', and 48" longitudinally disposed parallel with the rotation direction of the blade  
15 41 respectively on bottom surfaces of depressed portions 44 of non-diamond portion 45 and inner and outer divided surfaces of non-diamond portion 45 divided by depressed portions 44, as shown in FIG. 6.

Bottom surfaces of depressed portions 44 of  
20 non-diamond portion 45 are positioned on the plane forming the center between inner and outer surfaces of non-diamond portions 45 to let diamond layers 48' disposed thereon to form one microscopic linear cutting groove 47" in crushable materials 47 during the cutting operation  
25 of blade 41, as shown in FIG.7.

Thus, diamond layers 48, 48', and 48" on bottom surfaces of depressed portions 44 of non-diamond portion 45 and inner and outer surfaces of non-diamond portion 45 form three microscopic linear cutting grooves 47',  
30 47", 47"' in crushable materials 47 to let the protruded portions 50 and 50' of crushable materials 47 between the microscopic linear cutting grooves 47, 47', 47" to be

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easily crushed by small friction and rotation impact power of non-diamond portion 45 during the cutting operation of blade 41, as shown in FIG.7.

5 Also, in the non-diamond portion 45 of rim type cutting tip 43, diamond particles can be distributed in the density lower than that of diamond layers 48, 48' and 48".

10 Alternatively, in this embodiment of the present invention, the depth of bottom surfaces of depressed portions 54 in non-diamond portion 55 can be less than a half of the entire thickness of non-diamond portion 55 to let diamond layers 58' and 58" disposed thereon to form two microscopic linear cutting grooves 57" and 57"' in crushable materials 57 during the cutting operation of blade 51, as shown in FIG.10.

15 Thus, in this case, diamond layers 58, 58', 58", and 58"' on inner and outer surfaces of non-diamond portion 55 and bottom surfaces of depressed portions 54 thereof form four microscopic linear cutting grooves 57', 57", 57"' and 57"" in crushable materials 57 to let protruded portions 60, 60' and 60" of crushable materials 57 between the cutting grooves 57', 57", 57"' and 57"" to be easily crushed by small friction and rotation impact power of non-diamond portions 55 during the cutting operation of blade 51, as shown in FIG.10.

20 Operation of diamond blades having rim type cutting tip for use in apparatus such as cutting saw machine according to embodiments of the present invention will be described, hereinafter.

30 Referring to FIG.4, there is illustrated the operation of diamond blades 31 of one embodiment of the

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present invention which two thin diamond layers 38 and 38' are longitudinally disposed respectively in inner and outer surfaces of rim type cutting tip 33. At first, when wheel body 32 is rotated by an electric motor connected with a shaft thereof to cut crushable materials 37 such as brick, concrete, granite, marble, etc., cutting tip 33 begins to grind crushable materials 37 to form a cutting slot 36 therein along a predetermined line thereon.

At this time, since thin diamond layers 38 and 38' including particles 39 of diamond are disposed in inner and outer surfaces of cutting tip 33, both edges of cutting tip 33 are defaced less than center thereof and thereby two microscopic linear cutting grooves 37' and 37'' are formed in the cutting slot 36 of crushable materials 37, as shown in FIG. 5.

By forming cutting grooves 37' and 37'', portion 40 of crushable materials 37 therebetween is weakened and easily crushed by small friction and rotation impact power of non-diamond portion 35. Thus, non-diamond portion 35 of cutting tip 33 is able to produce cutting chips with relative large size and produced chips are easily discharged outside with reducing the friction with cutting tip 33 of blade 31, thereby to increase cutting ability and to prevent produced chips dispersing in the air.

In this way, by repeating the operation of cutting tip 33 of diamond blade 31, cutting crushable materials 37 along the predetermined line thereon is completed.

Referring to FIG.7 and 10, there are illustrated the operation of diamond blades 41 and 51 of the other embodiment of the present invention.

The operation of these diamond blades 41 and 51 is same that of the diamond blade 31 of embodiment

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noted above expect that diamond layers 48, 48", and 48", or 58, 58', 58", 58"', and 58"" on inner and outer surfaces of non-diamond portion 45 or 55 and bottom surfaces of depressed portions 44 or 54 form three or four linear cutting grooves 47', 47", and 47"', or 57', 57", 57"', and 57"" in crushable materials 47 or 57.

As apparent from the foregoing description, it can be appreciated that the present invention provides a diamond blade having rim type cutting tip which at least two diamond layers are longitudinally disposed along the rotation direction of the blade to form at least two microscopic linear cutting grooves in the crushable materials during cutting operation and thereby to cause portions of crushable materials between the cutting grooves to be easily crushed by non-diamond portions of cutting tip to enhance cutting ability of the blade.

Also, the present invention provides a diamond blade having a structure which cutting tip are able to produce cutting chips with relative large size during cutting operation so that those chip are easily discharged outside with reducing the friction with cutting tip of blade, thereby to increase cutting ability and to prevent it dispersing in the air and giving rise to the bad effects to user's health and the contamination of environment.

Also, the present invention provides a diamond blade having a rim type cutting tip which diamond particles in diamond layer thereof are distributed in a given pattern to reduce the amount of diamond particles used and thereby reduce the manufacturing cost of blade.



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What is claimed is:

1. A diamond blade having rim type cutting tip for use in grinding or cutting apparatus comprising ;  
a wheel body connected with a shaft of electric motor,  
5 and said rim type cutting tip for cutting or grinding crushable materials disposed on the circumference of said wheel body and composed of at least two diamond layers longitudinally disposed parallel with the rotation direction of the blade in which diamond particles are included, and non-diamond portion disposed between the  
10 diamond layers in which diamond particles are not included.
2. A diamond blade as claimed in claim 1, wherein said diamond layers are each other disposed at predetermined intervals perpendicular with the rotation direction of the  
15 blade between non-diamond portions of cutting tip.
3. A diamond blade as claimed in claim 1, wherein said diamond layers are only on inner and outer surface of rim type cutting tip.
- 20 4. A diamond blade as claimed in claim 1, wherein diamond particles in each diamond layer of rim type cutting tip are distributed in a given pattern or arrangement.
- 25 5. A diamond blade as claimed in claim 4, wherein diamond particles in each diamond layer of rim type cutting tip are distributed in single layer figure with grid shaped spots.

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6. A diamond blade as claimed in claim 4, wherein diamond particles in each diamond layer of rim type cutting tip are distributed in double layer figure with grid shaped spots.

5 7. A diamond blade as claimed in claim 1, wherein diamond particles in each diamond layer of rim type cutting tip are randomly distributed.

10 8. A diamond blade as claimed in claim 1, wherein in said non-diamond portion of rim type cutting tip, diamond particles are distributed in the density lower than that of diamond layers.

9. A diamond blade having rim type cutting tip for use in cutting or grinding apparatus comprising ;  
a wheel body connected with a shaft of electric  
15 motor, and said rim type cutting tip for cutting or grinding crushable materials disposed on the circumference of said wheel body and composed of non-diamond portion having a plurality of depressed portions disposed at predetermined intervals to cross each other in inner and  
20 outer surfaces of non-diamond portion, and a plurality of diamond layers longitudinally disposed parallel with the rotation direction of the blade respectively on bottom surfaces of depressed portions of non-diamond portion and inner and outer surfaces of non-diamond portion divided  
25 by depressed portions thereof.

10. A diamond blade as claimed in claim 9, wherein all bottom surfaces of depressed portions of non-diamond portion are positioned in the plane forming the center

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between inner and outer surfaces of non-diamond portion to let diamond layers disposed thereon to form one cutting line during the cutting operation of blade.

5 11. A diamond blade as claimed in claim 9, wherein the depth of all bottom surfaces of depressed portions of inner and outer surfaces of non-diamond portion is set up to be less than a half of the entire thickness of non-diamond portion to let diamond layers disposed thereon to form two linear cutting line during the cutting operation of blade.

12. A diamond blade as claimed in claim 9, wherein diamond particles in each diamond layer of rim type cutting tip are distributed in a given pattern or arrangement.

15 13. A diamond blade as claimed in claim 12, wherein diamond particles in each diamond layer of rim type cutting tip are distributed in single layer figure with grid shaped spots.

20 14. A diamond blade as claimed in claim 12, wherein diamond particles in each diamond layer of rim type cutting tip are distributed in double layer figure with grid shaped spots.

15. A diamond blade as claimed in claim 9, wherein diamond particles in each diamond layer of rim type cutting tip are randomly distributed.

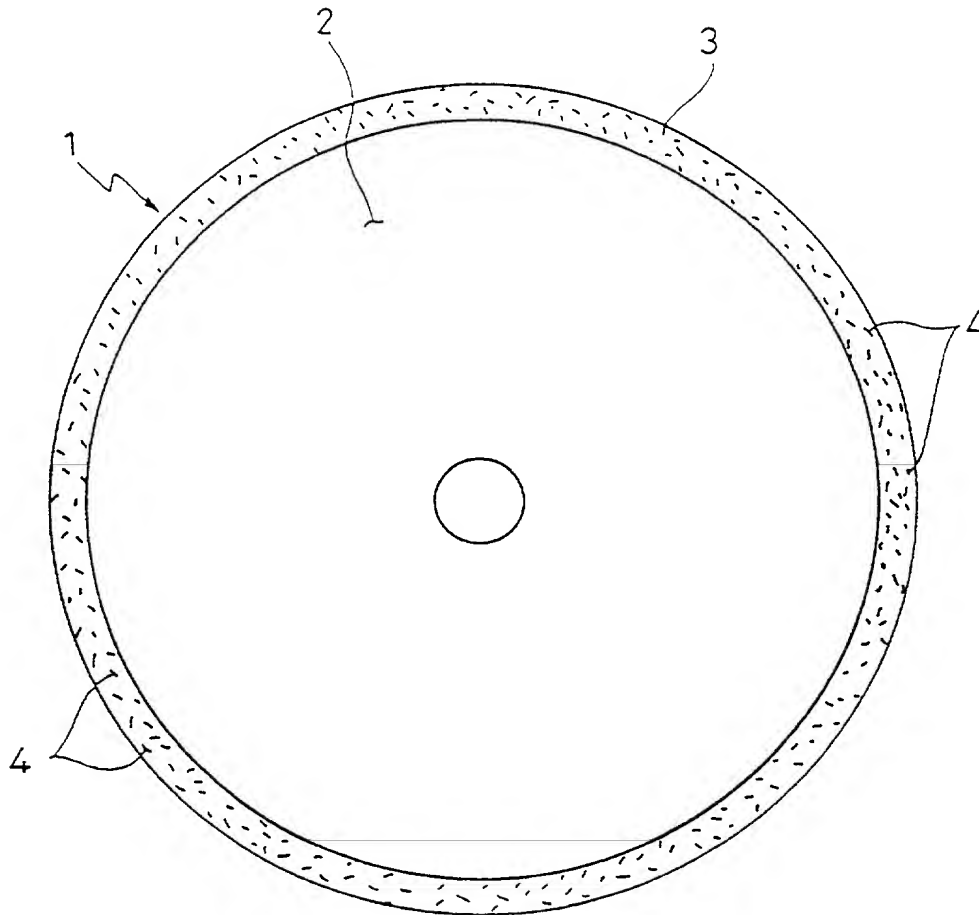
25 16. A diamond blade as claimed in claim 9, wherein in said non-diamond portion of rim type cutting tip, diamond

-17-

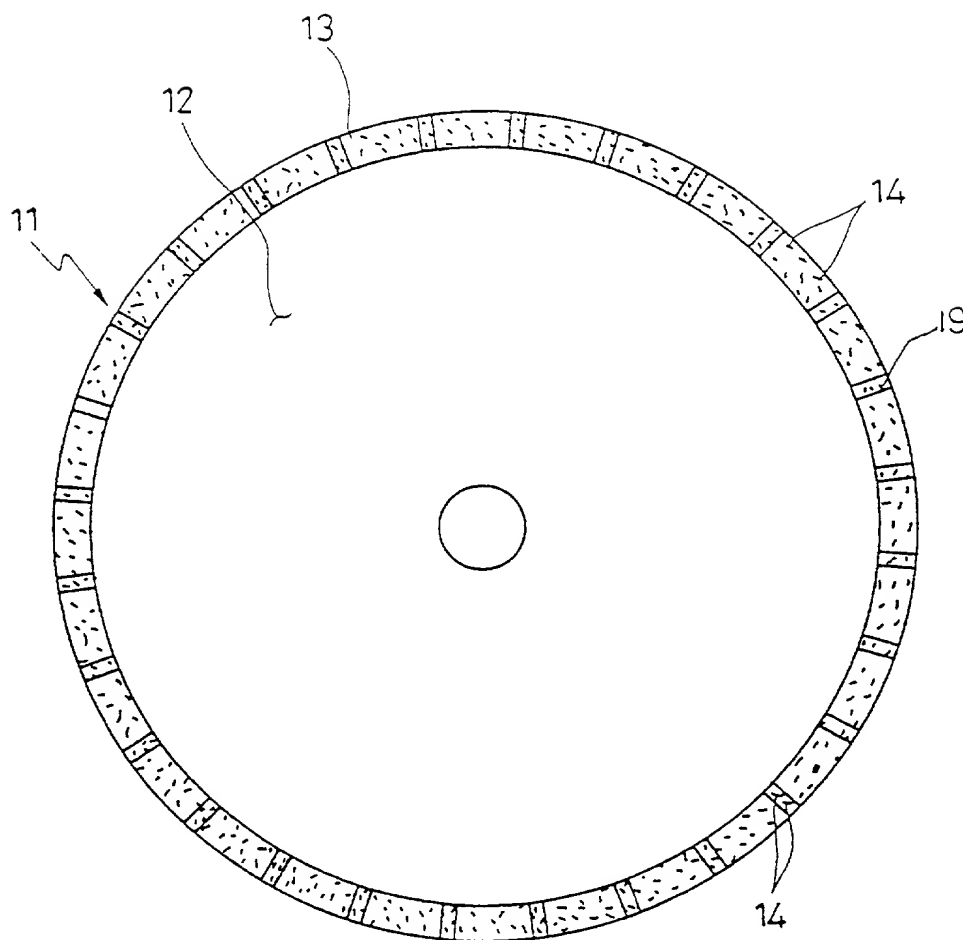
particles are distributed in the density lower than that of diamond layers.

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**FIG. 1**  
(PRIOR ART)



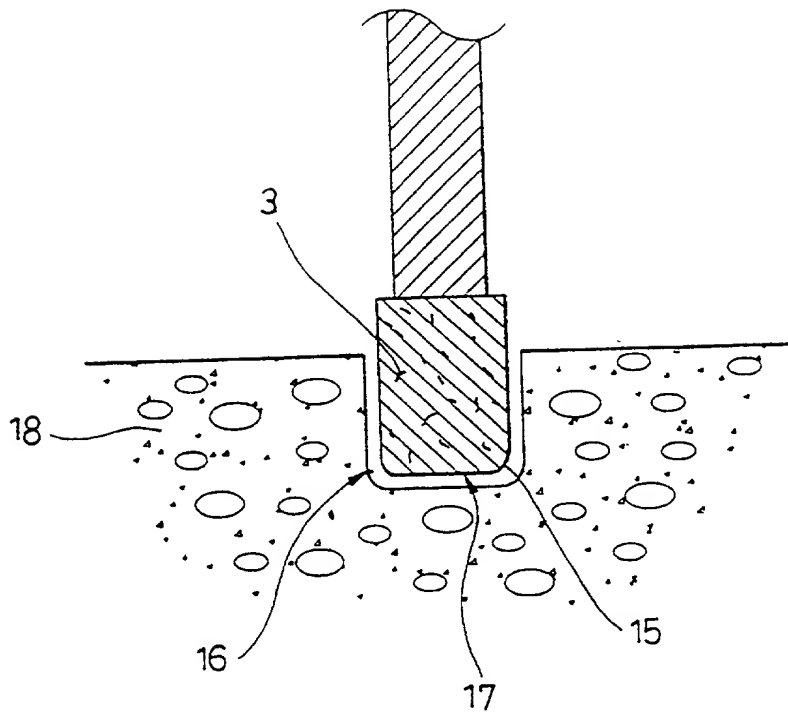
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**FIG.2**  
(PRIOR ART)



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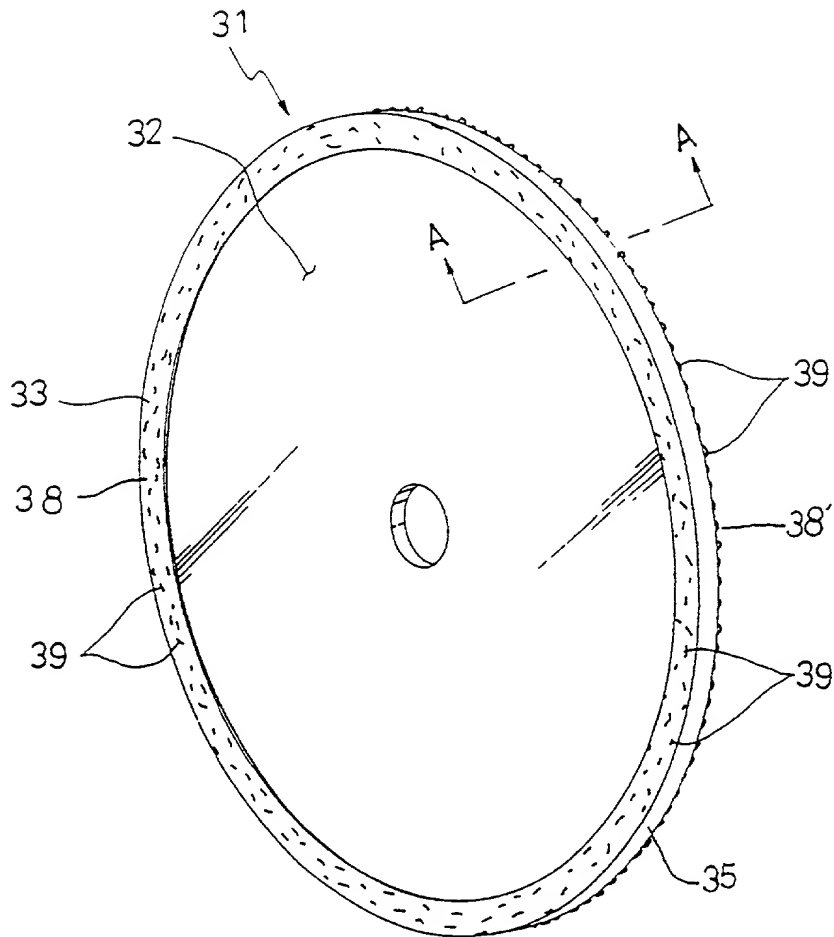
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**FIG.3**  
(PRIOR ART)



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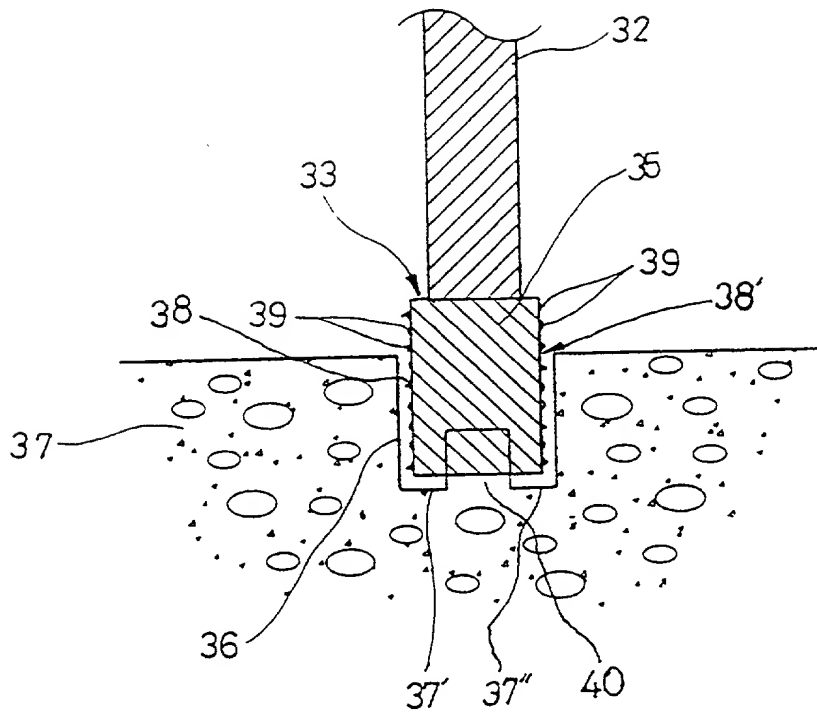
FIG. 4





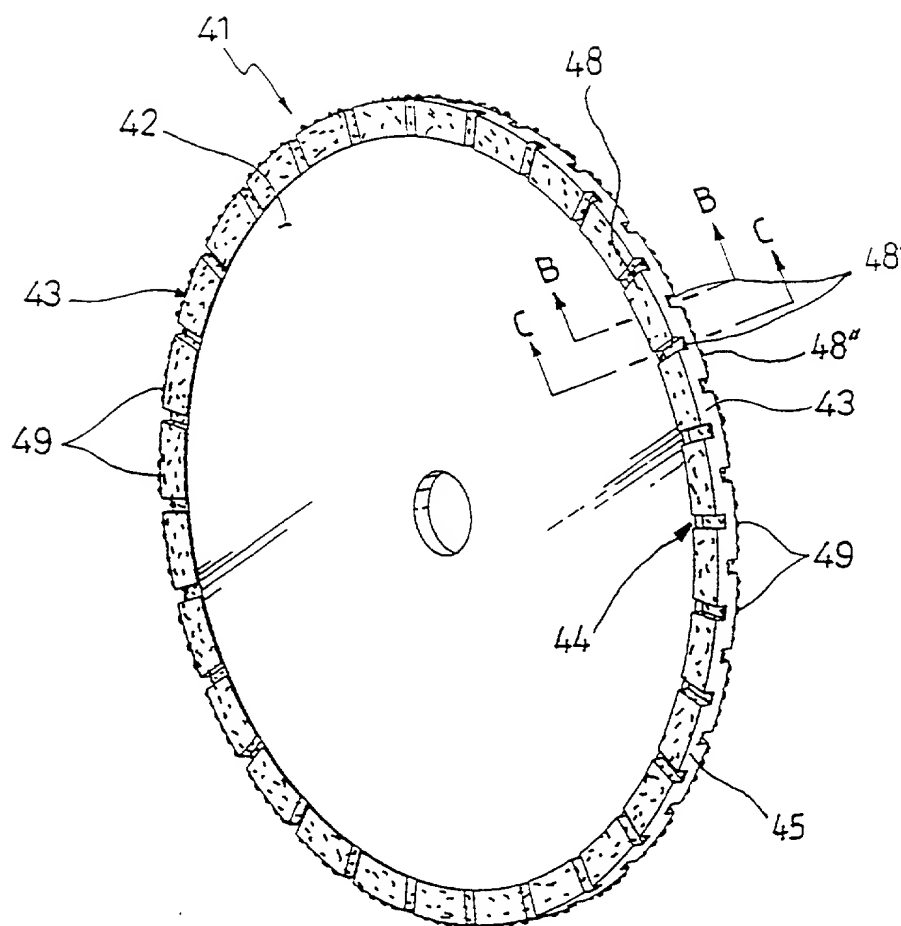
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FIG. 5



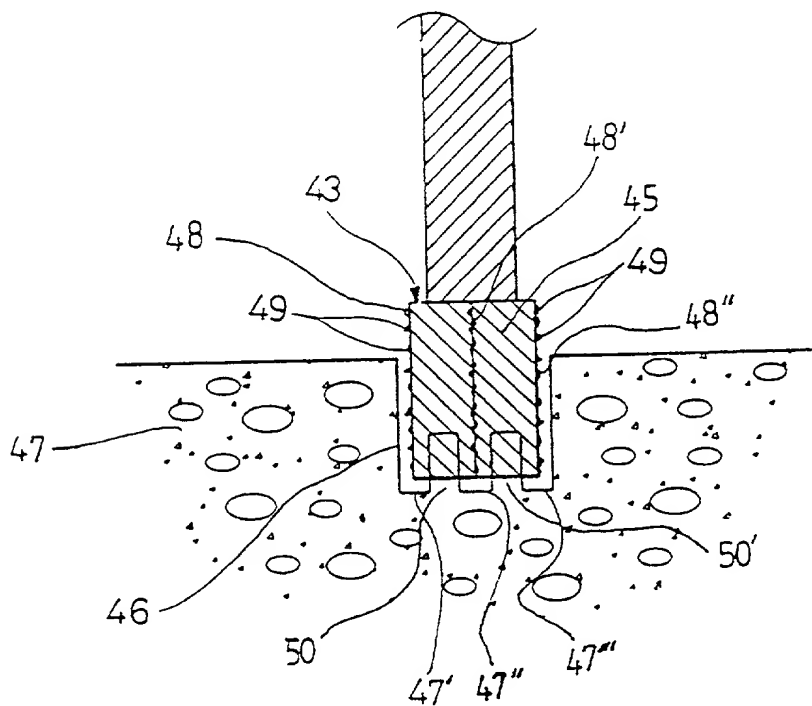
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FIG. 6



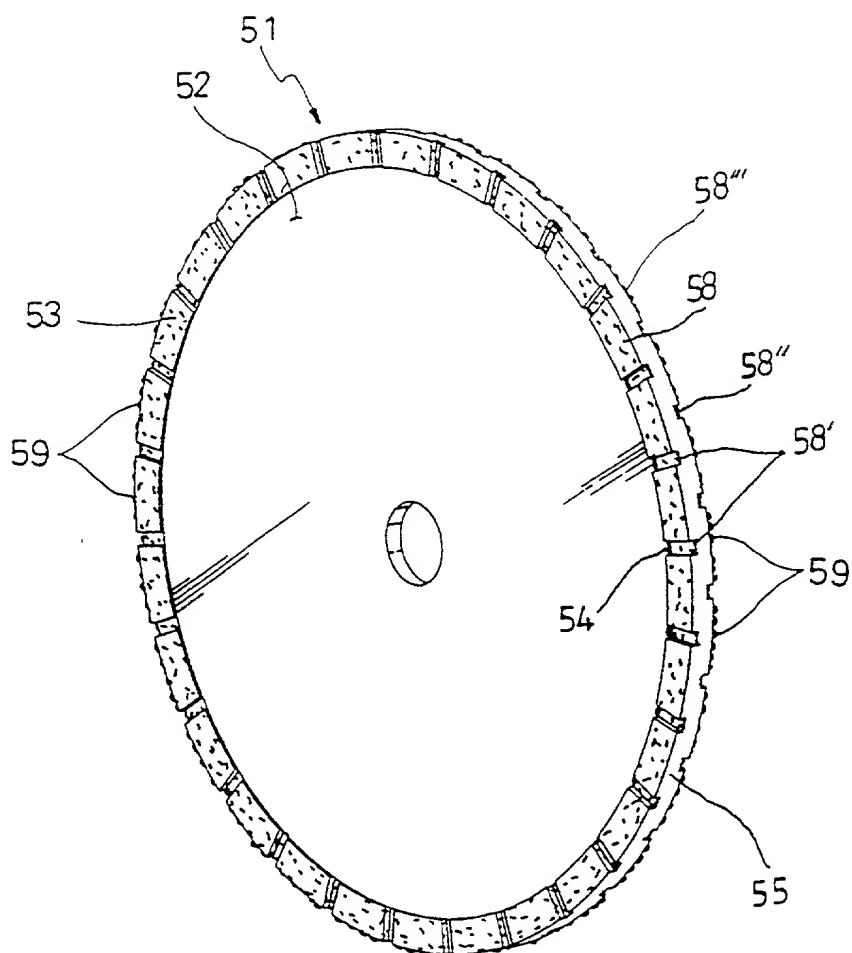
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FIG. 7



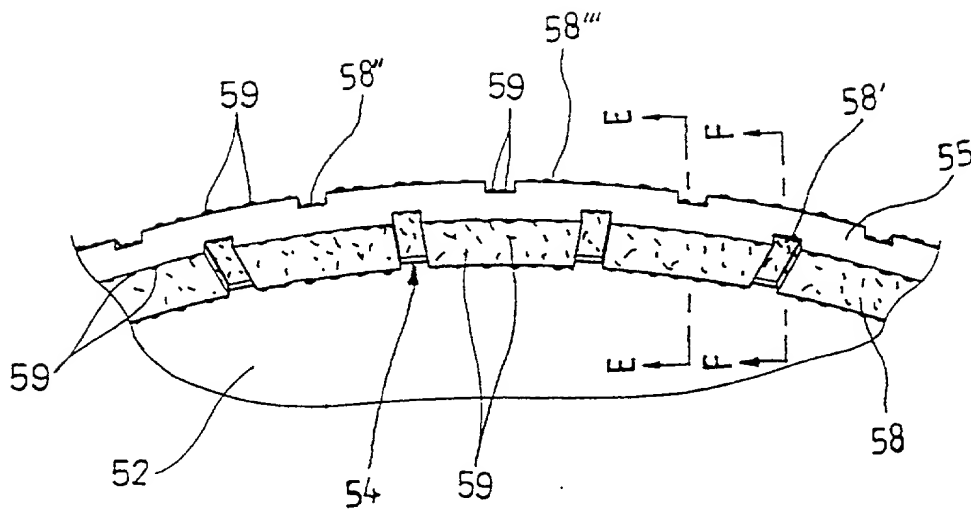
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FIG. 8



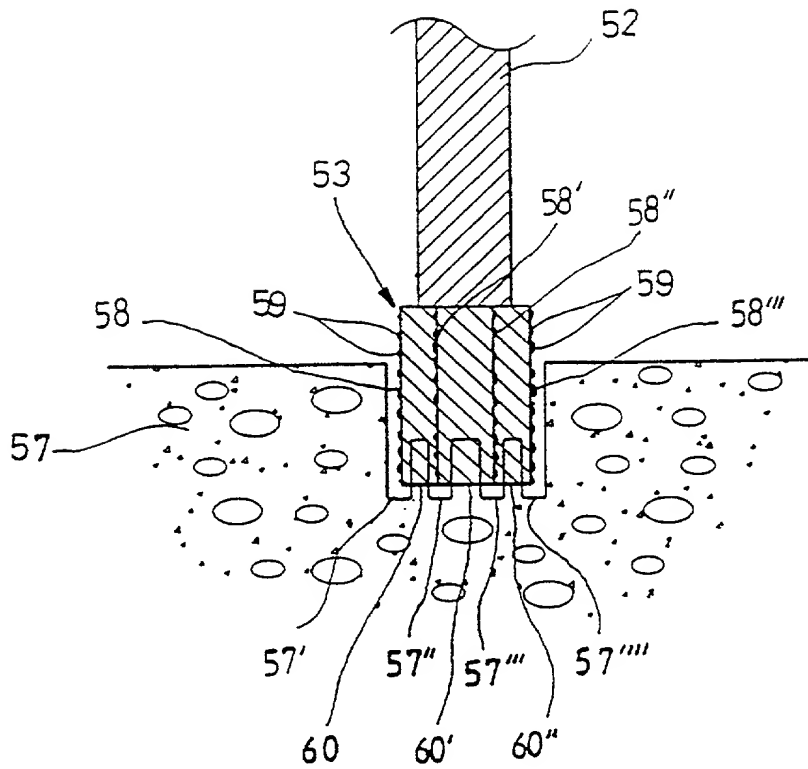
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FIG. 9



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FIG. 10



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09/786307  
#3

PATENT/DESIGN PATENT  
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor: KIM, Soo Kwang; YOON, So Young;  
LEE, Chang Hyun  
Title: DIAMOND BLADE HAVING RIM TYPE CUTTING  
TIP FOR USE IN GRINDING OR CUTTING  
APPARATUS

Filing Date:

Serial No.:

Docket No.: 540.2-9755

POWER OF  
ATTORNEY  
(ASSIGNEE FORM)

(Filing date, serial number and docket number may be left blank at time of signing)

The below named Assignee of the entire interest of the above identified patent application, filed concurrently herewith or for which the docket no., filing date and application number may be inserted above by any attorney of Vidas Arrett & Steinkraus, P.A., when known, hereby appoints the following attorneys to prosecute this application and any application claiming priority therefrom; to execute any terminal disclaimers; and to transact all business in the Patent and Trademark Office connected therewith and with any patent issuing therefrom:

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all of VIDAS, ARRETT & STEINKRAUS, Professional Association, Suite 2000, 6109 Blue Circle Drive, Minnetonka, Minnesota 55343, USA, Telephone (612) 563-3000, and I hereby authorize them to act and rely on instructions from, and to communicate directly with, the firm or person which sent this case to VIDAS, ARRETT & STEINKRAUS unless or until I instruct VIDAS, ARRETT & STEINKRAUS in writing to the contrary. I have authority to execute this document on behalf of the Assignee.

Date Apr. 23, 2001 (Name of Assignee) General Tool, Inc.

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(Title)

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PATENT/DESIGN PATENT  
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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LEE, Chang Hyun  
Title: DIAMOND BLADE HAVING RIM TYPE CUTTING  
TIP FOR USE IN GRINDING OR CUTTING APPARATUS

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ATTORNEY  
(ASSIGNEE FORM)

Filing Date:

Serial No.:

Docket No.: 540.2-9755

(Filing date, serial number and docket number may be left blank at time of signing)

The below named Assignee of the entire interest of the above identified patent application, filed concurrently herewith or for which the docket no., filing date and application number may be inserted above by any attorney of Vidas Arrett & Steinkraus, P.A., when known, hereby appoints the following attorneys to prosecute this application and any application claiming priority therefrom; to execute any terminal disclaimers; and to transact all business in the Patent and Trademark Office connected therewith and with any patent issuing therefrom:

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#3

PATENT/DESIGN PATENT

DECLARATION

As a below-named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I verily believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

DIAMOND BLADE HAVING RIM TYPE CUTTING TIP FOR USE IN GRINDING OR CUTTING APPARATUS

(Insert invention title)

the specification of which is attached hereto or, if not attached, was filed as International Application No.

PCT:      /      on     , 19    , designating the United States. (Insert PCT ser. no. and filing date if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to in the declaration.

I acknowledge the duty to disclose all information which is known to be material to patentability of this application in accordance with Title 37, Code of Federal Regulations §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119, of the foreign application(s) for patent or inventor's certificate designated below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

(List prior foreign applications)

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
KOREA	1998-36321	03, 09, 1998	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

I hereby declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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(Attach additional sheets for third and subsequent inventors)

Attorney Docket No. 540.2-9755

3-00

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Declaration - additional inventor sheet

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